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Near field of a transient, acoustically forced transitional and turbulent jets QI ZHANG, DANIEL BODONY, University of Illinois, Urbana Champaign — Acoustic liners are widely used to reduce aircraft engine noise. They work by converting acoustic-bound energy into vorticity-bound energy, in the form of a transient jet, at an orifice that is very small relative to the incident sound wavelength. At low sound amplitudes ($<$ 130 dB) the forced jet is laminar. At higher amplitudes ($>=$ 150 dB) vortical instabilities appear and the jet becomes turbulent. In this work the behavior of transitional and fully turbulent transient jets are studied using direct numerical simulations of the compressible Navier-Stokes equations. We focus on the near-aperture dynamics of the acoustically-forced fluid by quantifying the jets' phase-averaged properties and linking these to a reduced order dynamical model with the objective of understanding the motion of transient turbulent jets. Results indicate that boundary layer separation from the orifice walls is critical to seeding instabilities within the jets as they develop while at later times disturbances from the previous acoustic cycle reinforce the jets' unsteadiness.

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